

PALYNOLOGICAL EVIDENCE FOR THE
LATE GLACIAL OCCURRENCE OF PRINGLEA
AND LYALLIA ON KERGUELEN ISLANDS¹

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Kerguelen Islands are an isolated subantarctic archipelago situated in the southern Indian Ocean (Fig. 1). The nearest continental land masses other than Antarctica are Africa and Australia, each some 4,000 km distant. The native vascular flora of Kerguelen includes only about 30 species (Lourteig and Cour, 1963; Aubert de la Rüe, 1964). The majority of the non-endemic species have their affinities with the Magellanic flora of southern South America. A lesser number of species also occur in New Zealand and southern Australia. A few of the species found on Kerguelen, such as *Cystopteris fragilis* (L.) Bernh., are nearly worldwide in their distribution.

Six species are endemic to Kerguelen or to Kerguelen and such nearby islands as Heard and Crozet. Both the quantity and the nature of the endemic species are unique in the subantarctic, and this region has been considered to be a distinct phytogeographic province (Good, 1964), although most other provinces support floras of over 100 times as many species.

The validity of the concept of the Kerguelen phytogeographic province depends upon the assumption that the flora has been isolated for a long period of time. However, much of the surface of Kerguelen is presently covered with ice, and there is some reason to believe that virtually all of the island may have been glaciated, eliminating all sig-

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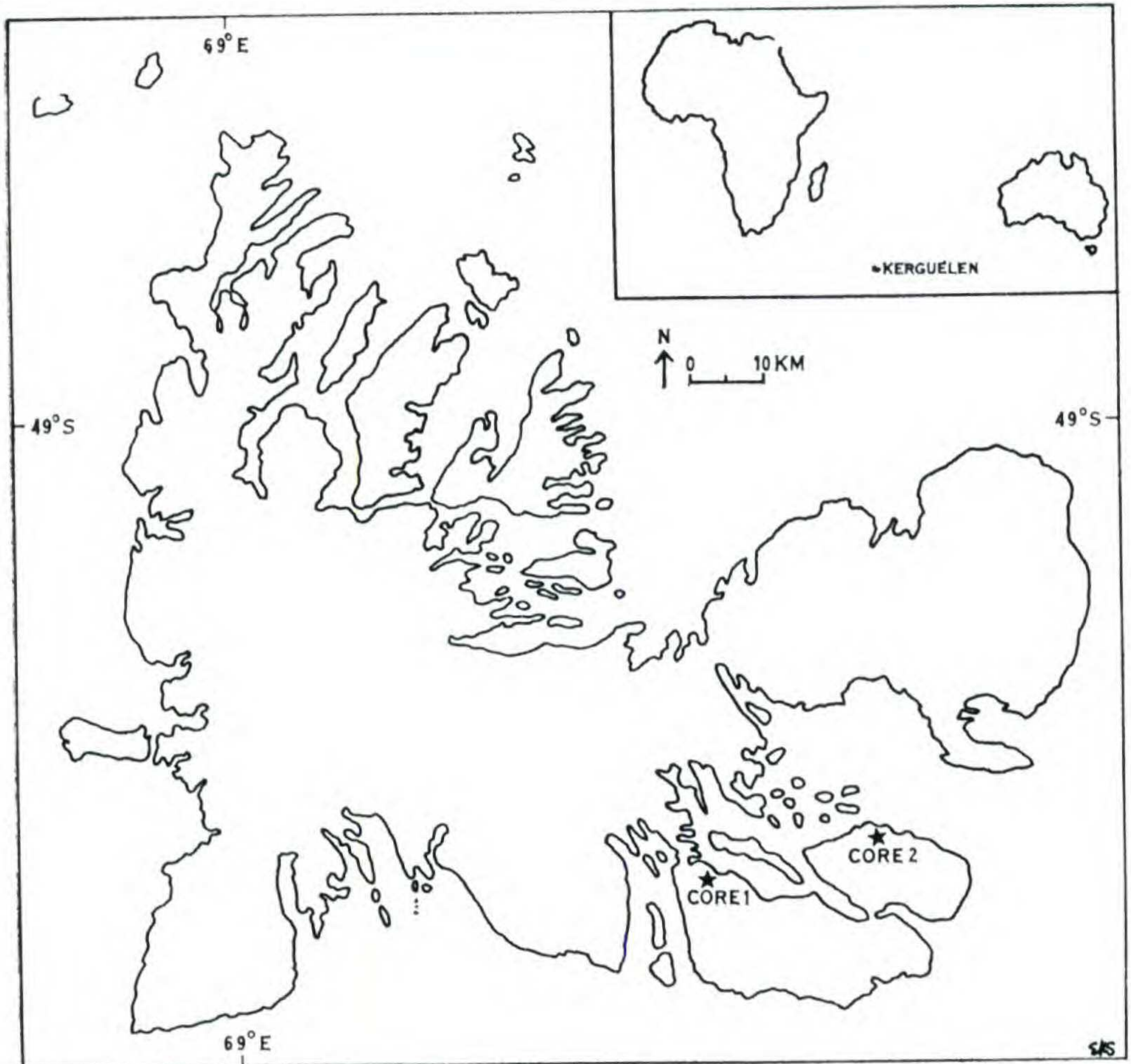


Fig. 1. Map of Kerguelen Archipelago with stars marking sites of cores. Inset shows position of Kerguelen in relation to Africa and Australia.

nificant vegetation during the Pleistocene. We now offer evidence that the most characteristic members of the Kerguelen endemic flora were present on the islands during the latter part of the last major glacial episode.

Four of the six species endemic to the Kerguelen region (*Poa Cookii* Hook, f., *P. kerguelensis* (Hook. f.) Steuder, *Colobanthus kerguelensis* Hook. f., and *Ranunculus Mosleyi* Hook. f.) belong to large genera which are well represented throughout most of the far south. Although all four species are reasonably distinct, there is no intrinsic reason to postulate a long period of isolation on Kerguelen for them.

The remaining two endemic species, *Lyallia kerguelensis* Hook. f. and *Pringlea antiscorbutica* R. Br. ex Hook. f., belong to monotypic genera which have no close relatives. In the subantarctic flora these two genera are unique with regard to their taxonomically isolated position, and they provide the main support for the contention that the Kerguelen region can properly be considered to be distinct phytogeographic province. It is known that Kerguelen supported a complex flora, including coniferous trees, during the mid-Miocene (Cookson, 1947; Nougier, 1970). If Kerguelen has never been completely denuded of its flora by ice advances, it is probable that *Lyallia* and *Pringlea* are the last living remnants of a Tertiary Kerguelenian flora.

Pringlea antiscorbutica, the well-known "Kerguelen cabbage", was used by seamen during the last century for the control of scurvy. It occurs on Kerguelen, Heard, Crozet, Marion, and Prince Edward Islands (Lourteig and Cour, 1963). *Pringlea* (Fig. 2) bears a superficial resemblance to the cultivated cabbage. The vegetative portion of the plant consists of a rosette of blue-green leaves which may lie nearly flat on the ground or may be borne atop a fleshy rootstock to 1 m tall and 10 cm in diameter. The inflorescence consists of one to several spikes which arise from the base of the rosette at its junction with the rootstock. The petals of the numerous flowers are reduced or absent.

Rabbits, which were introduced on Kerguelen in 1874 (Aubert de la Rüe, 1964) have apparently eliminated *Pringlea* from many of its former habitats, and it is now difficult to reconstruct the former natural distribution of the species. In areas not presently inhabited by rabbits, *Pringlea* is common to abundant in mesic situations near sea level, particularly where the soil has been enriched by sea-bird colonies. *Pringlea* will tolerate salt spray, and it is often found growing with *Cotula plumosa* Hook. f. in coastal situations. Plants of *Pringlea* are also found in high-elevation vegetation dominated by *Azorella selago*

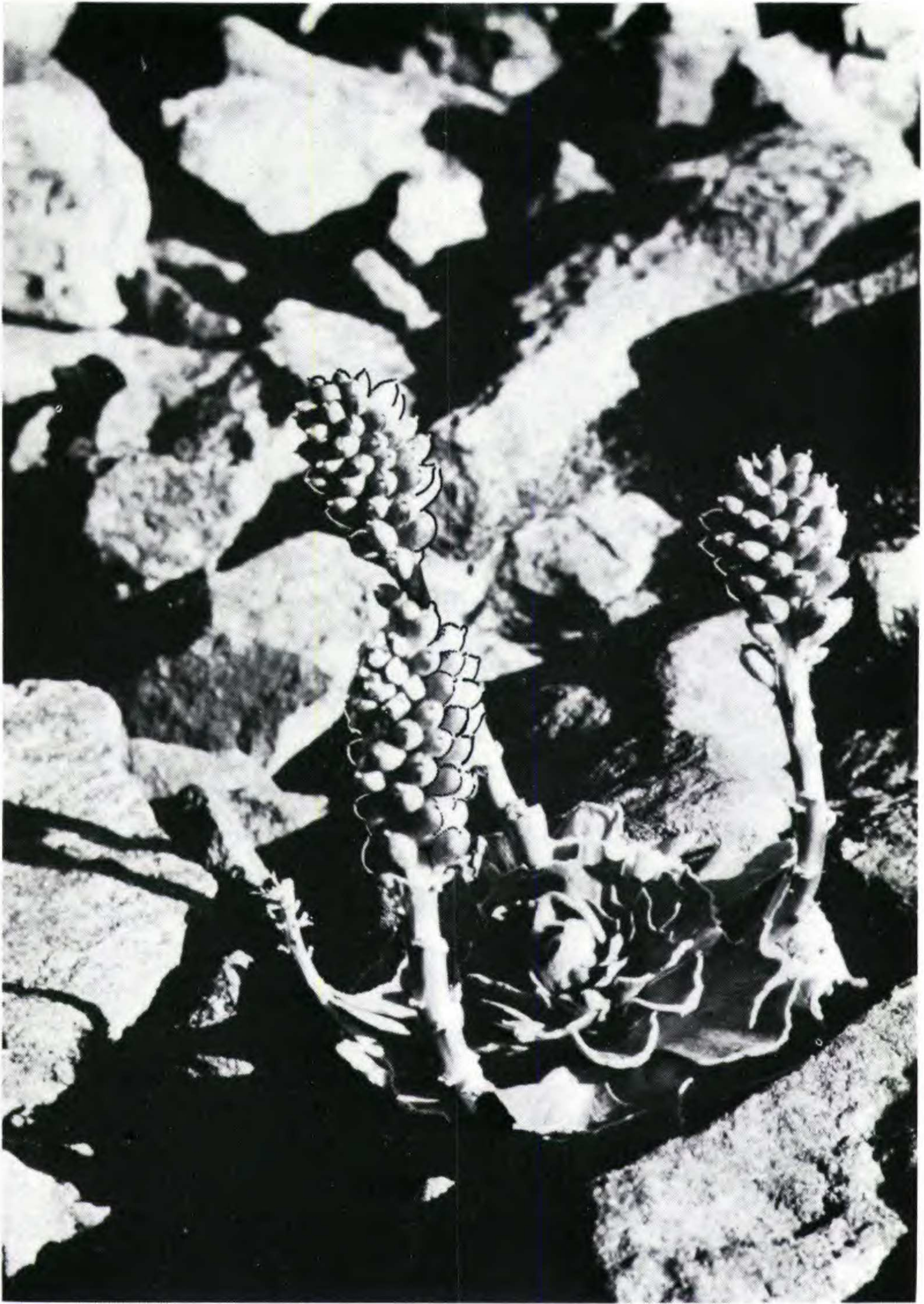


Fig. 2. *Pringlea antiscorbutica* R. Br. ex Hook. f. showing basal rosette of leaves and fruiting stalks. Although this specimen was found at an elevation of about 600 m, the leaves show evidence of rabbit grazing.

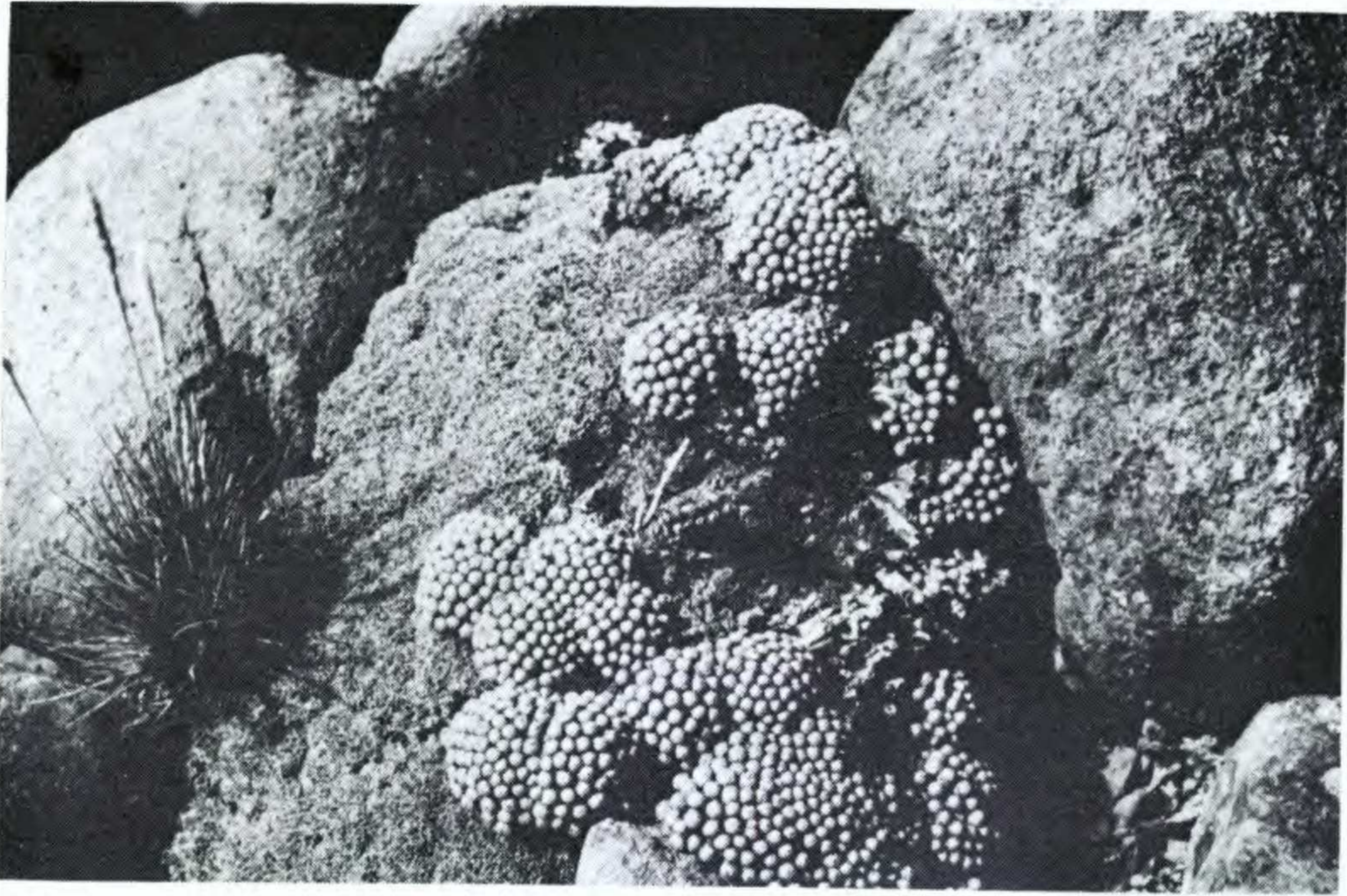


Fig. 3. *Lyallia kerguelensis* Hook. f.

Hook. f. where there is abundant moisture from seepage or meltwater. It is doubtful that *Pringlea* was ever a significant component of the vegetation of the upland wind deserts of Kerguelen. The species is never seen in boggy areas. It appears that *Pringlea* is tolerant of low temperatures and high winds, but that it requires a continuous supply of moisture and good drainage.

Lyallia kerguelensis occurs only on the Kerguelen archipelago. It is a dwarf cushion plant (Fig. 3) which is rather rare over most of the main island, although it is common on Long Island in the Gulf of Morbihan (H. A. Imshaug, personal communication). *Lyallia* grows mainly on stony barrens at low to moderate elevations.

Lyallia, with its small and highly reduced flowers, has been something of a puzzle to taxonomists since its discovery. First placed in the Caryophyllaceae by Hooker (1847), it was later transferred to the Portulacaceae (Kidder, 1876). More recently, *Lyallia* has been linked with the genus *Hectorella*, which is native to alpine areas in New Zealand, and both genera are considered to be in a

separate family, the Hectorellaceae (Philipson and Skipworth, 1961). The pollen of *Lyallia*, which is clearly neither portulacaceous or caryophyllaceous, supports the placement of the genus in another family (Cranwell, 1963).

PALYNOLOGICAL STUDIES

In February 1971, columns of peat and buried soils were collected from the sides of stream cuts in two locations on the south shore of the Gulf of Morbihan (Fig. 1). These cores have since been analyzed for pollen content and dated by radiocarbon techniques.

Core 1 is 308 cm long. A C-14 date at a depth of about 240 cm was 9230 ± 150 years B.P. (I-6661), while a date from a depth of about 250 cm was 8595 ± 125 years B.P. (I-6154). This small anomaly in the dates is most probably a result of contamination of the lower sample with recent material, but it could also be caused by the presence of reworked older sediments in the upper sample. If the 240-cm date is taken to be the most nearly correct, the lowermost strata of core 1 would probably have been deposited 12,000 to 12,500 years B.P. If the 250 cm date is accepted, the oldest strata would be 1,000 to 1,500 years younger. The strata below the bottom of core 1 contained large, rounded boulders embedded in blue clay-silt. These strata may be of glacial origin.

Core 2, which was 550 cm long, did not penetrate to any till-like strata. Buried organic soils were found below the bottom of the core, but seepage problems made sampling impossible. A sample from a depth of approximately 525 cm was dated at $11,010 \pm 160$ years B.P. (I-6284). If we consider the late glacial-postglacial boundary in the far southern hemisphere to be about 10,000 years B.P. (Heusser, 1966; Flint, 1971), both cores include late glacial sediments.

There can hardly be doubt that the glaciers of Kerguelen were more extensive during parts of the Pleistocene than they are now, but evidence for total glaciation of the islands

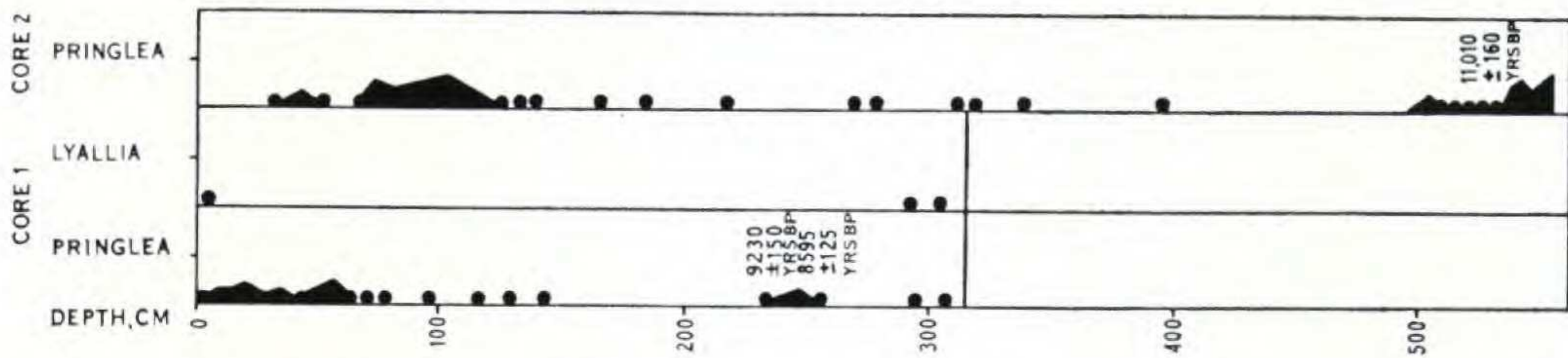


Fig. 4. Partial pollen diagram showing distribution of *Pringlea* and *Lyallia* pollen in cores 1 and 2. The percentages are based on a total count of 150 grains per sample. Each division at the top represents 10% and a dot represents 2% or less.

is lacking (Bellair, 1965). As the site of core 2 was ice-free well into glacial times, we suggest that it may not have been glaciated during the Pleistocene.

The pollen and spore content of the Kerguelen cores is presently being analyzed as a means of reconstructing the late Quaternary climatic history of the islands. Neither *Pringlea* nor *Lyallia* was found to be a major constituent of the pollen rain, but some pollen of both species was found in the cores (Fig. 4). *Pringlea* pollen was present in the lowermost samples of both cores. At the bottom of core 2, *Pringlea* pollen amounted to 6% of the total pollen counted, a percentage as high as was found in any other sample in either core. *Pringlea* was a constituent of the vegetation near the site of core 2 more than 11,000 years ago. If the relative lack of *Pringlea* pollen in some of the upper levels of the cores has any significance, it may indicate that *Pringlea* was replaced at low elevation by less cold tolerant species. The *Pringlea* pollen content of core 1 was similar to that of core 2 except that there was no peak at the lowest levels.

Lyallia pollen was much rarer than that of *Pringlea*; it was never found in core 2 and was found in only three samples from core 1. However, the presence of clearly identifiable *Lyallia* pollen at the bottom of core 1 shows that the species did grow on the island more than 10,000 years ago. *Lyallia* is neither an abundant plant nor does it flower heavily on Kerguelen at present; thus, its comparative rarity in the pollen record is not surprising.

In view of the evidence presented here, we may state with certainty that both *Pringlea* and *Lyallia* were present on Kerguelen during late-glacial times. The presence of pollen of these species in our oldest samples, coupled with the lack of evidence for complete glaciation of Kerguelen, suggests that these species did indeed "overwinter" the Pleistocene epoch on Kerguelen. It is not necessary to postulate an extra-insular refugium for these species, with subsequent migration to Kerguelen and extinction in the refugial area. *Pringlea* and *Lyallia* are probably true relicts of an otherwise extinct Tertiary Kerguelenian flora.

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